GE Energy

Motor Installation And Maintenance Instructions

Vertical AC Small Industrial Motors

NEMA Frame Sizes: 213 to 449
NEMA Type P Base, Weather Protected Type 1
High Thrust, Hollow and Solid Shaft
Ball Type Non-Reverse Couplings
And Bolted Couplings
Models: 5KXXXDTTXXXX
Models: 5KEXXXDTTXXXX

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Table of Contents

I. General Information 1
- A. How to Properly Use this Instruction Manual 1
- B. Safety Symbols 1
- C. Safe Motor Operation Information 2
- D. Description of Labels and Nameplates 3
- E. Model and Serial Numbers 3
- F. Relevant Industry Standards 3

II. Receiving 3
- A. Unpacking 4
- B. Temporary Storage 4
- C. Extended Storage 4
- D. Handling 4

III. Installation 4
- A. Location 4
- B. Mounting 5
- C. Power Supply and Connections 5

IV. Operation 6
- A. Steps Prior to Starting 6
- B. Initial Start 7
- C. Jogging and Repeated Starts 7

V. Maintenance 8
- A. General 8
- B. General Cleanliness 8
- C. Insulation and Windings 8
- D. Vacuum and Compressed Air Cleaning 8
- E. Cleaning with Water and Detergent 9
- F. Bearings and Lubrication 9
- G. Couplings 11
- H. Re-Assembling the Upper End 12

VI. Operational Difficulties 13

VII. Failure 14

VIII. Repair 14

IX. Renewal Parts 14

X. Fastener Torques 15

XI. Coupling Assembly 16
- A. 210 – 280 Frame Non-reverse and Bolted Coupling 16
- B. 320 – 449 frame Non-Reverse and Bolted Coupling 18

I. GENERAL INFORMATION

A. How to Properly Use this Instruction Manual

This installation and maintenance manual has been written to assist the user with proper procedures when handling, installing, operating and maintaining the equipment. All of the safety warnings and instructions in this manual must be followed to prevent injury to personnel.

This manual must be kept for future reference during installation, operation and maintenance.

B. Safety Symbols

Below is a safety symbol table that identifies the safety symbols that appear in this manual and on the motors.

The use of a lightning bolt within an arrowhead symbol, enclosed in a yellow triangle warns of dangerous electrical voltage that could cause an electric shock to a person.

The use of an exclamation point within a yellow triangle indicates to the user that important installation, operating and maintenance instructions must be followed.

The use of wavy lines, enclosed in a yellow triangle, indicates that the motor can be hot and should not be touched without taking proper precautions.

This symbol instructs one to read the manufacturer's instruction manual before installation, operation and maintenance.

This symbol identifies a terminal, which is intended for connection to an external grounding conductor for protection against electric shock in case of a fault.

The use of a small case "i" enclosed in a square indicates a general note.

WARNING: Indicates a procedure or condition that, if not strictly observed, could result in personal injuries or death.

CAUTION: Indicates a procedure or condition that, if not strictly observed, could result in minor injuries to personnel.

This symbol indicates the need to wear hearing protection.

C. Safe Motor Operation Information

***WARNINGS**: High voltage and rotating parts can cause serious or fatal injuries. Qualified personnel should perform installation, operation and maintenance of electrical machinery. For equipment covered by this instruction manual, it is important to observe safety precautions to protect personnel from possible injury. Be sure to keep the installation and maintenance information for future reference. All warnings and cautions must be followed.*

Installation

- *Avoid contact with energized circuits and rotating parts.*
- *Avoid bypassing or rendering inoperative any safeguards or protective devices.*
- *Avoid use of automatic-reset thermal protection where unexpected starting of equipment might be hazardous to personnel.*
- *Avoid contact with capacitors until safe discharge procedures have been followed.*
- *Be sure the motor shaft key is captive before the motor is energized.*
- *Avoid long exposure in close proximity to machinery with high noise levels.*
- *When the motor is coupled to equipment, ensure that system vibrations are within acceptable limit (per ISO 10816-1) to avoid failure of the motor.*
- *Use proper protective gear, care and procedures when handling, lifting, installing, operating and maintaining the motor.*
- *If eyebolts are used for lifting motors, they must be securely tightened, and the direction of the lift must not exceed a 15° angle from the shank of the eyebolt. Do not use eyebolts in an ambient below 0°F. At temperatures below 0° F, the eyebolt could fail resulting in injury to personnel and/or damage to equipment. Drop-forged eyebolts per American Society of Testing Materials A489 or equivalent must be used.*
- *Do not use the motor shaft as a means for lifting.*
- *Do not lift both the motor and driven equipment with the motor lifting means.*
- *Do not stand on or place objects on the motor.*

Maintenance

Safe maintenance practices performed by qualified personnel are imperative. Before starting maintenance procedures, be positive that:

- *Equipment connected to the shaft will not cause mechanical rotation.*
- *Main motor windings and all accessory devices associated with the work area are disconnected from electrical power sources.*
- *The motor has been given time to cool.*

Failure to properly ground the frame of the motor can cause serious injury to personnel. Grounding should be in accordance with National and local Standards and consistent with sound practice.

These instructions do not purport to cover all the details in motors nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

This document contains proprietary information of General Electric Company, USA and is furnished to its customer solely to assist that customer in the installation, testing, operating and/or maintenance of the equipment described. This document shall not be reproduced in whole or in part, nor shall its contents be disclosed to any third party without the written approval of GE Energy.

D. Description of Labels and Nameplates

Motor rating and identification data are furnished on packing labels and motor nameplates. Motor nameplates provide a permanent record of motor characteristics, plant identification and date of manufacture. Below is an example of a label that is attached to the shipping package.

MOD – GE model number
KW = Motor power rating
RPM = Motor speed at full load
VOL – Motor voltage
ENCL = Enclosure code
FR = Frame size
MASS = Motor mass

Typical Packing Label

E. Model and Serial Numbers

As discussed in section D, every motor that is manufactured by GE Energy has a model number and a serial number, which are permanently marked on the motor nameplate. When contacting a GE Energy Service Shop or representative, please provide the model and serial numbers.

Data and information regarding an individual motor model number can be obtained from the Data Pack for the motor or through EliteNet or by contacting your local GE Energy representative.

F. Relevant Standards

1. Motors shipped with this Installation and Maintenance Instruction have been designed and built to the latest revision of the following standards:

    a. NEMA MG-1

2. Motors that have the IECEx designation have also been designed to meet the requirements of the following standards:

    a. IEC and/or BS/EN 60079-0
    b. IEC and/or BS/EN 60079-15

3. Motors with the CE Mark have also been designed to meet the requirements of the following EU directives:

    a. Machinery safety
    b. Low Voltage
    c. Electromagnetic Compatibility
    d. Conformity Assessment

II. RECEIVING

Each motor should be carefully inspected upon receipt. Motor rating and identification data are furnished on a packing label for verification purposes. Any damage should be reported promptly to the carrier and a claim filed. The nearest GE Energy sales office may provide additional guidance.

A. Unpacking

If the motor has been exposed to low temperatures, unpack it only after it has reached the temperature of the room in which it will be unpacked. Otherwise the motor windings will be exposed to condensing moisture.

B. Temporary Storage (Up to 6 Months)

If the motor will not be put into service immediately, certain precautions should be taken to protect the motor while in storage. **It is recommended the motor be placed under cover in a clean, dry location.**

During storage, windings should be protected from excessive moisture by some safe and reliable method of heating, such as space heaters, to keep the temperature of windings above the temperature of the surrounding air. It is recommended that the motor in storage be inspected at periodic intervals, the windings meggered and a log kept of pertinent data. (Refer to the **OPERATION** section.) Any significant drop in insulation resistance should be investigated.

Precautions are taken by the factory to guard against corrosion. The machined parts are coated to prevent rust during shipment. If the equipment is to be stored, examine the machined parts carefully for rust and moisture and recoat where necessary.

Motors with oil-lubricated or oil-mist lubricated bearings are normally operated and tested in the factory with a rust-inhibiting oil in the lubrication system. A rust-inhibiting film remains on critical bearing surfaces during transit and for up to six months in storage.

Rotate the shaft of all grease-lubricated motors 10-20 revolutions at two-month intervals.

If the purchaser has specified the machine be packaged for long-term storage, the foregoing recommendations do not apply and the packing should be left intact during the period of storage.

C. Extended Storage (Longer than 6 months)

In the event the motor is to be stored longer than six months, please refer to GE Instruction Manual GEK-97427.

D. Handling

WARNING*: Lifting lugs on the motor are designed for handling only the motor. They are not to be used to lift the motor plus additional equipment such as pumps, compressors or other driven equipment. In the case of assemblies on a common base, lugs or eyebolts provided on the motor are not to be used to lift the assembly and base. The assembly should be lifted by a sling around the base or by other lifting means provided on the base*

III. INSTALLATION

WARNING*: Installation should be in accordance with the 'USA-National Electric Code' or 'BS/EN 60204-1' and 'BS/EN 60204-11' and consistent with sound National and local practices. Coupling, belt and chain guards should be installed as needed to protect against accidental contact with moving parts. Motors accessible to personnel should be further guarded by screening, guard rails, etc., to prevent personnel from coming in contact with the equipment.*

A. Location

Locate the motor in a clean, well ventilated area. The motor enclosure is designed such that dripping, wind-blown and splashing water will not damage the motor. Under conditions of extreme weather and moisture, additional protection, such as a pump house, is recommended. The free flow of air around the motor must not be obstructed. The ambient air temperature should not exceed the value on the motor Nameplate.

B. Mounting

1. Motors with Oil-Lubricated bearings must be mounted on a level surface to prevent oil leakage and for proper operation of the oil sight glass.

2. The motor base should be bolted down square with the pump head and at right angles with the pump shaft. Bolt the motor to the pump head using bolts of the largest size permitted by the clearance holes in the motor base.

3. The mounting bolts must be tightened to prevent changes in alignment and possible damage to the equipment. It is recommended that a washer be used under each nut or bolt head to get a secure hold on the base. As an alternative, flanged nuts or bolts may be used. The recommended torques are listed in the **FASTENER TORQUES** section below.

4. Vertical Hollow Shaft Motors (VHS)
   Remove the hood or top hat and the upper half-coupling from the motor. Lower the motor onto the pump head with the pump shaft extending through the motor's hollow shaft. The pump shaft should be centered within the motor's hollow shaft.

   Non-Reverse Coupling (NRC) – See the Coupling Assembly Section below.
   These motors are typically equipped with a Non-reverse coupling (NRC) that permits rotation in the CCW direction viewed from the coupling end of the motor. The NRC system consists of a stationary ratchet plate with slotted ramps and a rotating ball carrier that retains several steel balls. When the motor starts in the forward (CCW) direction, the slotted ramps in the ratchet plate lift the balls above the ratchet plate where they are held in place by centrifugal force as the motor speed increases. When the motor speed decreases, the balls move down due to the decreasing centrifugal force and then prevent CW (reverse) rotation by locking against the vertical edge of the slots in the ratchet plate.

	Coupling halves should have a close sliding fit on their mating parts and must be securely locked to avoid damage in operation. If it is necessary to drive the coupling into position, it is important that the other end of the shaft be supported so the force of driving on the coupling does not damage the lower end bearing. Failure to comply may result in extensive damage to the bearing.

   Fit the upper half-coupling onto the motor and key it to the pump shaft with the gib key. Put on the adjusting nut supplied with the pump and draw up on the impellers. Lock the adjusting nut in place with a screw through the nut into a tapped hole in the coupling.

5. Vertical Solid Shaft Motors (VSS)
   These motors are provided with a shaft extension suitable for direct coupled loads. Use flexible couplings if possible.
   Accurate mechanical lineup is essential for successful operation. Mechanical vibration and roughness in running the motor may be an indication of poor alignment. In general, lineup by straight edge across, and feeler gauges between coupling halves is not sufficiently accurate. It is recommended that the lineup be checked with a dial indictor and checking bars connected to the motor and load-machine shafts. The space between coupling hubs should be maintained as recommended by the coupling manufacturer. Shaft offset should not exceed 0.002". Angular misalignment should be less than 0.002".

C. Power Supply and Connections

1. Nameplate voltage and frequency should agree with the power supply. Motors will operate satisfactorily on line voltage within ±10% of the nameplate value or frequency within ±5%, combined variation not to exceed ±10%.

2. Dual voltage motors can be connected for the desired voltage using instructions on the nameplate or the connection diagram.

3. When mounting conditions permit, the conduit box may be rotated so that the conduit entrance can be made upward, downward, or from either side.

WARNING*: Motor and control wiring, overload protection and grounding should be in accordance with the USA –'National Electric Code' or 'BS/EN 60204-1' and/or 'BS/EN 60204-11' and consistent with sound local practices*.

IV. OPERATION

A. Steps Prior to Starting

1. Oil lubricated bearings
   Drain any oil from the oil reservoir that was put in upon receipt of the motor or during long term storage by removing the drain plug located at the bottom of the oil sump.

   Replace the drain plug.

   Refer to the lubrication nameplate on the motor.

   With the motor at standstill, fill the oil reservoir per the information on the lubrication nameplate.

   Replace the filler plug.

2. Insulation Resistance

WARNING*: If the motor has been in a damp location, dry it out thoroughly before operating. Before energizing the motor for the first time or after an extended shut down, it is advisable to check the insulation resistance, power supply and mechanical freedom of the motor.*

In accordance with established standards, the recommended minimum insulation resistance for the stator winding when measured with a 500 volt DC direct indicating ohmmeter with self-contained power supply (megger), shall not be less than 5 mega-ohms at 40°C for a motor rated under 1000 volts, and not less than 100 mega-ohms at 40°C for a motor rated over 1000 volts. If the insulation resistance is lower than this value, it is advisable to eliminate the moisture in one of the following ways.

a. Dry the winding in an air-circulating oven with the air surrounding the winding at 110°C, +5/-15°C until the winding has been above 90°C for at least four hours. Then the air temperature may be raised to 150°C, +5°C/-15°C. Continue to heat until the insulation resistance is constant for a one-half-hour period.

b. Enclose the motor with canvas or a similar covering. Leave a hole at the top for moisture to escape. Insert heating units or lamps and leave them on until the insulation resistance is constant for a one-half hour period.

c. With the rotor locked mechanically and using approximately 10% of rated voltage, pass a current through the stator windings. Increase the current gradually until the winding temperature reaches 90°C. Do not exceed this temperature. Maintain a temperature of 90°C until the insulation resistance becomes constant for a one-half hour period.

B. Initial Start

WARNING: ***Be sure the motor is not running and the power supply is disconnected before performing the final checks.***

1. Whenever possible, examine the interior of the motor for loose objects or debris and remove any such foreign material.

2. If possible, turn the rotor by hand to ensure that it rotates freely.

3. Check all connections with the connection diagram(s) including auxiliary devices. Check all accessible factory made connections for tightness to make sure none has become loose during shipment.

4. Some motors are designed for unidirectional rotation. Rotation of these motors must be in accordance with the rotation indicated on the motor's nameplate and the outline furnished with the equipment. Connection plates on the motor have been furnished to assist in obtaining the proper rotation.

5. It is best to run the motor uncoupled from its load during the initial start to make certain it rotates in the correct direction. Vibration, noise, voltage and current unbalance can also be checked.

   To run a VHS motor uncoupled, it is recommended that the pump head-shaft be removed. If this cannot be done, remove the upper half-coupling and be sure the pump shaft is well centered in the motor shaft. Rotate the motor by hand to ensure there is no interference between the shafts. Do not try to run the motor uncoupled by just removing the gib key.

   If it is necessary to change rotation, interchange any two line leads.

6. After inspecting the motor carefully, make the initial start by following the regular sequence of starting operations in the motor starter control instructions.

7. Check motor operation under load for an initial period of at least one hour to observe whether any unusual noise or hot spots develop.

8. In the event of excessive vibration or unusual noise, disconnect the motor from the load and check the mounting and alignment.

9. Check the operating current against the nameplate value. Do not exceed the value of nameplate current multiplied by the motor service factor (if any) under steady continuous load.

10. Space heaters (if supplied) should be de-energized during motor operation.

C. Jogging and Repeated Starts

CAUTION*: Repeated starts and/or jogs of induction motors greatly reduce the life of the winding insulation. The heat produced by each acceleration or jog is much more than that dissipated by the motor under full load. If it is necessary to repeatedly start or jog a motor, it is advisable to check the application with the local GE Energy sales office.*

V. MAINTENANCE

WARNING*: Before initiating maintenance procedures, disconnect all power sources to the motor and accessories. For motors equipped with surge capacitors, do not handle the capacitors until they are discharged by a conductor simultaneously touching all terminals and leads including earth. This discharge conductor should be insulated for handling. Replace all normal grounding connections prior to operating.*

A. General

If the motor is dismantled during maintenance, sealing compounds (if any) need to be removed from the machined rabbets (spigots). When reassembling the motor, all machined surfaces forming metal-to-metal joints should be sealed with watertight sealing compound (Tite-Seal, GE Spec. A50CD427A or equivalent).

Inspect the motor at regular intervals, depending on service. Keep the motor clean and the ventilation openings clear.

In addition to the daily observation of the overall condition, it is recommended that a general inspection routine be set up to check periodically the following items:

1. General cleanliness
2. Insulation and windings
3. Lubrication and bearings
4. Coupling Bolt tightness

B. General Cleanliness

The interior and exterior of the motor should be kept free from dirt, oil, grease and conducting dust. Debris and/or dust may build up and block off ventilation. Any of these contaminants can lead to early motor failure.

C. Insulation and Windings

To obtain a long life and satisfactory operation of insulated windings, they should be kept clean from dirt, oil, metal particles and other contaminants. A variety of satisfactory and acceptable methods are available for keeping the windings clean. The choice of method will depend greatly on time, availability of equipment and on the insulation system. Vacuum cleaning with non-metallic hose tips should precede cleaning with water and detergent or witt solvents. Tightly adhering dirt will require removal by gentle brushing or wiping.

WARNING: ***To prevent injury to the eyes and respiratory organs, safety glasses and suitable ventilation or other protective equipment should be used.***

D. Vacuum and Compressed Air Cleaning

Compressed air should be used to remove loose dirt and dust from air passages.
Suction should be used to remove dirt from the windings to avoid damaging the coils.

CAUTION: ***Care must be taken to make sure the air is dry and that the air pressure is not more than 21 x 10^3kg/m^2 (30 psi).***

WARNING: ***Operator must not use compressed air to remove dirt or dust from his or her person and clothing.***

E. Cleaning with Water and Detergent

This method is very effective in cleaning windings when used with a low-pressure steam jenny with maximum steam pressure 30 psi and 90°C.

CAUTION*: To minimize possible damage to varnish and insulation, a fairly neutral non-conductive type of detergent such as DuBois Flow should be used. A pint of detergent to 76 liters (20 gallons) of water is recommended.*

If a steam jenny is not available, the cleaning solution may be applied with warm water by a spray gun. After the cleaning operation, the windings should be rinsed with water or low-pressure steam.

Dry the windings. Refer to the **Insulation Resistance** section above, for instructions on how to proceed.

F. Bearings and Lubrication

1. Grease Lubricated Bearings
   The grease used as a lubricant in grease-lubricated anti-friction bearings loses its lubricating ability over a period of time. For a given bearing construction and assembly, the lubricating ability of a grease over time depends primarily on the type of grease, the size of the bearing, the speed at which the bearing rotates and the severity of operating conditions. As a result, it is not possible to accurately predetermine when new grease must be added. Good results can be obtained if the general recommendations stated in this manual are followed.

   The primary function of grease is to supply the essential lubrication oil from the sponge-like reservoir of its soap structure. Grease-lubricated bearings consume only a small amount of lubricant. This lubricant must always be present to avoid rapid wear and bearing failure. Excessive or too frequent lubrication may also damage the motor.

   Grease lubricated bearings are lubricated at the factory. Motors with grease fittings should be lubricated in accordance with these instructions to provide maximum bearing life.

2. Type of Grease

   Motors are assembled with Shell Alvania R3 grease in the factory.
   Some equivalent greases are:
   Polyrex EM – Exxon
   BRB-2 - Chevron
   AeroShell #5 – Shell Oil Company,
   Hi Temp - Texaco, Inc.

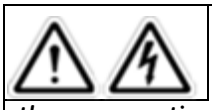
3. The table below lists relubrication intervals for motors under normal, steady running conditions, in a relatively clean atmosphere at 40°C ambient temperature or less.

   A standard 10,000 PSI (68.950 kPa) 16 ounce (473 mL) grease gun delivers approximately 0.04 oz. (1.18 mL) of grease with each pump, and a 24 oz. (710 mL) gun delivers approximately 0.06 oz. (1.77 mL) of grease.

Amount and Interval Table
for Grease Lubricated Bearings

Frame Size	Upper Thrust Brg	Number of Pumps		Lower Guide Brg	Number of Pumps		Lubrication Intervals (days)		
		16 Oz. Gun (Approx. 473 mL)	24 Oz. Gun (Approx. 710 mL)		16 Oz. Gun (Approx. 473 mL)	24 Oz. Gun (Approx. 710 mL)	2 Pole	4 Pole	6 Pole
213-215	7309	25	17	6209	25	17	120	180	180
254-256	7311	25	17	6309	25	17	120	180	180
284-286	7311	25	17	6311	25	17	120	180	180
324-326	Oil Lube	Oil Lube	Oil Lube	6312	25	17	120	180	180
364-365	Oil Lube	Oil Lube	Oil Lube	6313	25	17	120	180	180
404-405	Oil Lube	Oil Lube	Oil Lube	6314	44	29	80	180	180
444-445	Oil Lube	Oil Lube	Oil Lube	6314	44	29	N/A	180	180
447-449	Oil Lube	Oil Lube	Oil Lube	6218	44	29	N/A	180	180

4. Procedure for Regreasing



WARNING*: Lubrication maintenance should be performed with the motor stationary and disconnected from the power source. Extreme caution must be exercised to avoid contact with rotating parts or electrical wiring if the motor must be lubricated while running. Failure to observe these precautions may result in damage to the equipment, injury to personnel, or both.*

a. Stop the motor and disconnect it from the power supply.
b. Clean dirt and debris from around the grease inlet fitting and the grease outlet plug.
c. Remove the grease outlet plug and clean the opening and outlet tube of hardened grease. This may be accomplished with a twisted wire brush or sturdy pipe cleaner.
d. Add grease with a hand-lever operated gun only. Add only the amount of grease specified in the table above.
e. Run the motor for about ten minutes before replacing the outlet plug.

CAUTION: *Failure to observe the foregoing instructions for re-greasing may result in over greasing, grease leakage and/or bearing damage. To avoid damage to equipment, bearings and grease must be kept free of dirt.*

Because this method of greasing bearings tends to purge the housing of used grease over a period of time, removal of all grease should be required infrequently. A GE Energy Authorized Service Shop can clean the bearing cavity and replace the bearings and grease when the motor is removed from service for maintenance or reconditioning.

5. Oil Lubricated Bearings

Maintain proper lubrication by checking the oil level periodically and adding oil when necessary. Because of the clearing action of the bearing as it accelerates, and the expansion of the oil as it gets hotter, the oil level at the sight glass will be higher after the motor has been in operation for a while than it is with the motor at standstill and cold. The normal level, with the motor stopped and the oil cold, is marked STANDSTILL LEVEL on the sight gage.

Overfilling should be avoided not only because of the possibility that expansion may force the oil over the oil sleeve and into the motor, but also because operating with the oil level too high prevents the bearing from clearing itself of excess oil. The resultant churning can cause extra loss, high temperatures and oxidized oil.

If during operation, the oil level goes above the maximum shown on the sight gage, drain enough oil to bring the level back within the operating range. To drain the oil, remove the drain plug below the sight gage. Do not permit the operating oil level to fall below the minimum shown on the gage.

If it ever becomes necessary to add excessive amounts of make-up oil, investigate for oil leaks.

Change oil at regular intervals. The time between oil changes depends upon the severity of operating conditions and, hence, must be determined by the motor user. One or two changes a year is average, but special conditions, such as high ambient temperature, may require more frequent changes. Avoid operating the motor with oxidized oil. Use only best grade, oxidation and corrosion inhibited turbine oil produced by reputable oil companies. The lubrication nameplate on each motor specifies the viscosity range of oil suitable for average conditions.

Operation in ambient temperatures that are near or below freezing may require preheating the oil or the use of a special oil.

Too viscous an oil could cause the following:

a. Increased fluid friction losses resulting in higher operating temperatures. Higher temperatures will cause the oil to oxidize and break down at an accelerated rate.
b. Oil tends to churn or foam more than a less viscous oil.
c. Bearings may run warmer because of reduced oil circulation through and around the bearings.

Too light an oil may allow the oil film to wipe or break down.

6. Inspecting Thrust bearings and Couplings

The parts should be removed in the following order: (1) top hat, (2) drive nut on the pump shaft, (3) upper half coupling, (4) ball carrier, (5) ratchet balls, (6) locknut and washer, (7) ratchet plate, (8) lower half coupling and bearing. When the thrust bearing is removed, the upper bracket can be lifted off the frame after removing the bracket bolts. If required, the rotor and shaft can be lifted out with the upper bracket by removing the lower bearing cap bolts.

i	**NOTE:** ***Warranty may be voided if internal maintenance or repairs are not performed by a GE Energy Authorized Service Shop***

G. Couplings

The condition of non-reverse couplings should be checked periodically. If dirt has caused the action of the balls to become sluggish, the ball carrier should be removed, disassembled and thoroughly cleaned with a suitable solvent. The parts should then be dried and reassembled. See the Coupling Assembly section below.

Sometimes, after a long period of operation with frequent stops and starts, the surface of the holes in the ball carrier becomes polished, so that friction forces will no longer hold the balls clear of the ratchet plate when the motor is running. This condition can be remedied by roughening these surfaces with a piece of emery paper wrapped around a rod.

Bolts on both bolted couplings and non-reverse couplings should be checked periodically to be sure they are tight. See **FASTENER TORQUES** below.

H. Re-Assembling the Upper End

The lower guide bearing is restrained to take momentary up thrust. When reassembling the upper bearing and coupling, it is important to avoid a preload stress on the guide and thrust bearings. The following assembly procedure should be used.

1. Leave the shaft locknut loose.

2. Tighten the lower bearing cap bolts.

3. Tighten shaft locknut and raise the shaft until the bearings are just starting to preload. When slight preloading is experienced, there is no endplay and the rotor will not turn as freely by hand.

4. After slightly preloading the bearings, back off the shaft locknut approximately 1/4 turn.

5. If the equipment is available, it is desirable for the shaft endplay be checked using a dial indicator to measure movement as the rotor and shaft are raised and lowered. Shaft endplay should be 0.005 in. to 0.020 in. (0.127 mm to 0.508 mm).

6. When proper endplay is established, lock the nut in place with the shaft lock washer.

VI. OPERATIONAL DIFFICULTIES

Some operating difficulties may occur. Common causes are given in the table below and should be corrected as soon as possible.

Trouble Shooting Table

Affected Parts	Difficulty	What to Check
Windings	Overheating	Calibration of measuring instrument Unbalanced voltage Unbalanced Current Excessive Current Variable Frequency Drive Harmonics Improper or restricted ventilation Dirty windings Excessive ambient temperature Short circuited coil or windings
Bearings	Overheating	Calibration of measuring instrument Oil Viscosity Worn out or dirty oil Worn out or dirty grease Insufficient Oil Excessive or insufficient grease Misalignment Excessive thrust or radial loading Shaft currents Incorrect Endplay/Bearing preload
Motor	Excessive Vibration	Mechanical Unbalance Misalignment Improper or settled foundation Non-uniform air gap Rubbing parts Bent shaft Unbalanced stator current Damaged bearing Reed Critical frequency Incorrect Endplay/Bearing preload
Winding Insulation	Low insulation resistance or insulation failure	Moisture, dirt, metal particles, oil, or other contaminants on the windings Moisture from a Wash Down Moisture from severe weather Wrong voltage Excessive temperature Voltage surges/lightning Mechanical damage Excessive vibration with resultant mechanical damage Single-phasing

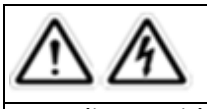
VII. FAILURE

WARNING: ***An extreme overload or electrical failure may result in heating or arcing which can cause the insulation to give off noxious fumes. All power should be removed from the motor circuit as a precaution even though the circuit has overload protection. Personnel should not approach the motor until adequate ventilation of the area has purged the air of fumes. When covers of a motor are removed after a failure, care should be observed to avoid breathing fumes from inside the motor. Preferably, time should be allowed for the motor to cool before attempting any examination or repair.***

WARNING: ***Water should not be applied to any electrically energized equipment because electric shock could result in serious or fatal injury. In case of fire, disconnect all power and use a carbon dioxide extinguisher to quench the flame. Before operating any motor after a suspected failure, it should be inspected for damage.***

VIII. REPAIR

If a motor is marked with IECEx or ATEX designation and repairs are required, the motor must be repaired by operators trained in the understanding of BS/EN 60079-1 and BS/EN 60079-15 standards. The motor has been designed to meet the rigid requirements of these standards. Repair or alteration of the motor may result in the motor no longer meeting the requirements of these standards. If major repairs are undertaken (such as rewinding a stator), proper facilities should be made available and suitable precautions observed.



WARNING: ***When burning off old insulation materials or when welding near insulation during rewinding, adequate ventilation must be provided to avoid exposing personnel to noxious fumes. Combustion of exhaust must be complete and adequately vented to the outside atmosphere in compliance with acceptable standards. Exposure of personnel to air-borne inorganic fibers must be avoided by adequate ventilation or by wetting the remaining insulation components following the burning of the organic materials.***

IX. RENEWAL PARTS

The use of only GE Energy renewal parts is recommended. When ordering, specify the model number and the serial number of the motor (complete nameplate data is desirable). Specify quantity and describe the part.

For information and service, refer to the nearest GE Energy Sales Office or a GE Energy Authorized Service Shop.

X. FASTENER TORQUES

A. Medium carbon steel fasteners per ASTM A449 Type 1.
B. Stainless steel fasteners per ASTM F593.
C. Threaded holes in parts for fasteners are per System 21, ASME/ANSI B1.3
D. SAE Grade 5 bolts have 3 radial marks on the head.
E. SAE Grade 8 bolts have 5 radial marks on the head.
F. Low carbon steel bolts have no marks on the head.
G. Low carbon steel bolts - Use 50% of the Grade 5 Torque.

Medium Carbon Steel SAE Hardware Grade 5 Fastener Torques (Unless otherwise specified)

Screw/Bolt Size	Typical Application	Torque (Inch-Lb)	Torque (N-M)
#10 Low Carbon Steel	Bearing Cap	15 - 25	1.7 – 2.8
¼" Low Carbon Steel (M6)	Bearing Cap	35 - 60	4.0 – 6.8
¼" (M6)	All Parts, except Bearing Cap and Fan Cover	70 – 96	7.9 – 10.8
¼" Grade 8 (M6)	Fan Cover Mounting	100 - 145	11 – 16
5/16" (M8)	Bearing Cap	78 - 120	8.8 – 14
5/16" (M8)	All Parts, except Bearing Cap	170 - 250	19 – 28
3/8" Low Carbon Steel (M10)	Conduit Box Cover	180 – 240	20 – 27
3/8" (M10)	All Parts, except Conduit Box Cover	250 – 370	28 – 42
½" (M12)	All Parts	610 – 920	70 – 100
5/8" (M16)	All Parts	1440 - 2160	163 - 244
¾" (M20)	All Parts	2150 – 3200	240 – 360

Stainless Steel SAE Hardware Property Class 50 Fastener Torques

Screw/Bolt Size	Typical Application	Torque (Inch-Lb)	Torque (N-M)
#10	Bearing Cap	15 – 25	1.7 – 2.8
¼" (M6)	Bearing Cap	35 – 60	4.0 – 6.8
¼" (M6)	All parts, except Bearing Cap	60 - 75	6.8 – 8.5
5/16" (M8)	Bearing Cap	78 – 120	8.8 – 14
5 /16" (M8)	All parts, except Bearing Cap	130 – 155	15 – 18
3/8" (M10)	All Parts	230 – 275	26 – 31
½" (M12)	All Parts	550 - 670	62 – 76
5/8" (M16)	All parts	1100 – 1340	120 – 150
¾" M20)	All Parts	2000 - 2360	230 - 270

XI. COUPLING ASSEMBLY

A. 210 - 280 Frame Non-Reverse and Bolted Coupling

Coupling Kit Packing List

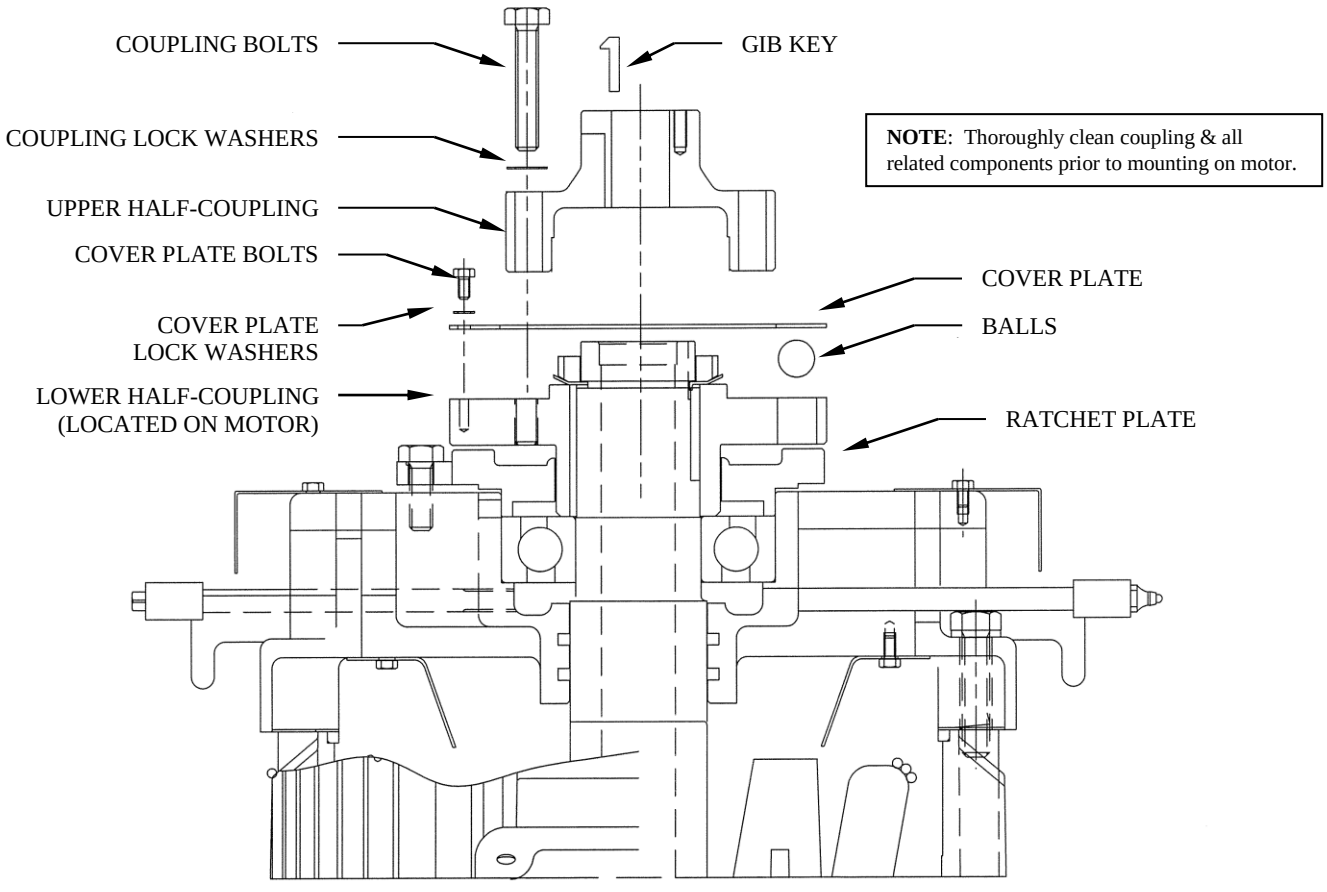
Item	Quantity
Coupling	1
Coupling Bolts	3
Coupling Lock Washers	3
Cover Plate	1
Cover Plate Bolts	5
Cover Plate Lock Washers	5
Steel Balls	10
Gib Key	1
Instructions	1

Bolt Torque Chart

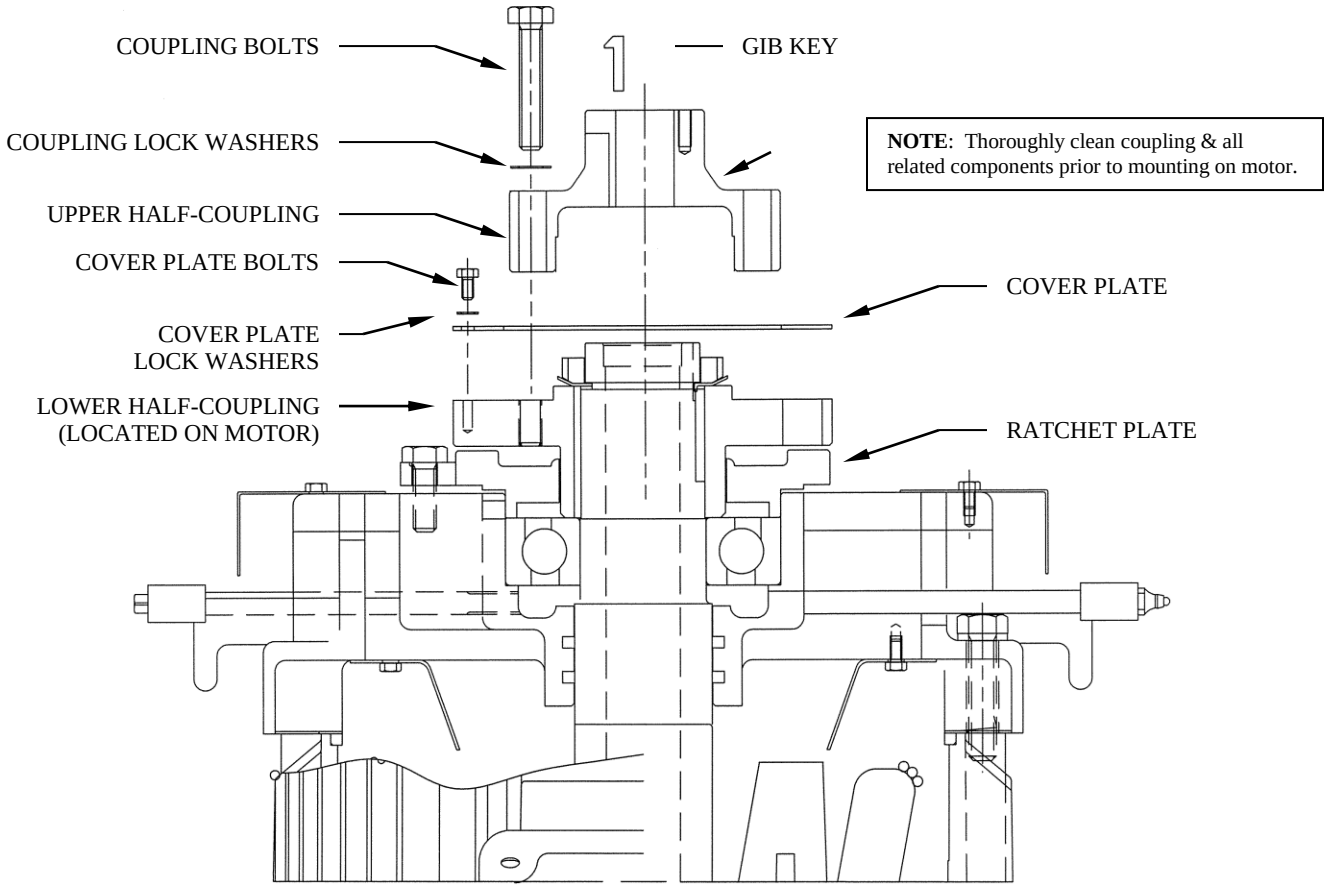
Frame Size	Item	Torque (Ft-Lb)	Torque (N-M)
210	5/16 - 18 UNC x 1-3/4 Coupling Bolt	17	23
250 - 280	3/8 - 16 UNC x 2-1/4 Coupling Bolt	30	41
210 - 280	1/4 - 20 UNC x 1/2 Cover Plate Bolts	8	11

Caution	***It is the installer's responsibility in all cases to ensure these torque values are used and maintained. This includes those instances when the coupling comes mounted in the motor. Failure to comply may cause the coupling bolts to break, with resultant, extensive damage to the equipment.***

1. Non-Reverse Coupling



2. Bolted Coupling - Steel balls not used on Bolted Coupling assemblies.



B. 320 - 449 Frame Non-Reverse and Bolted Coupling

Coupling Kit Packing List

Item	Quantity
Upper Half Coupling	1
Coupling Bolts	6
Coupling Lock Washers	6
Cover Plate	1
Cover Plate Bolts	5
Cover Plate Lock Washers	5
Balls	10
Gib Key	1
Instructions	1

Bolt Torque Chart

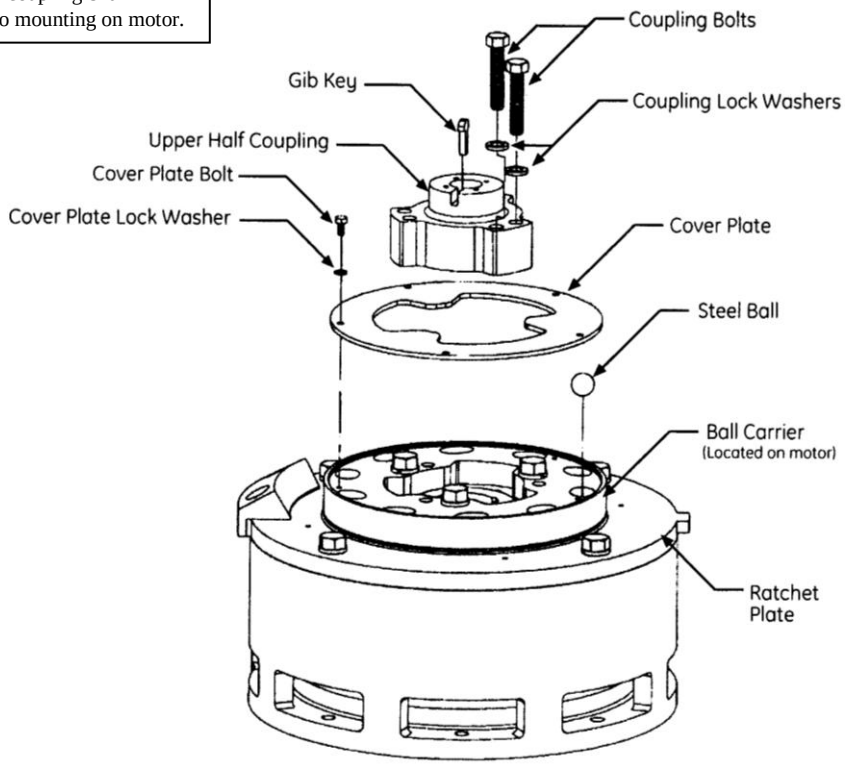
Part Name	Frame Size	Item	Torque (Ft-Lb)	Torque (N-M)
Cover Plate Bolts	320/440	1/4 - 20 UNC x 5/8 Bolt	8	11
Coupling Bolts	320/360	1/2 - 13 UNC x 2-1/2 Bolt	75	102
Coupling Bolts	400/440	5/8 - 11 UNC x 3-1/2 Bolt	150	203

Caution

It is the installer's responsibility in all cases to ensure these torque values are used and maintained. This includes those instances when the coupling comes mounted in the motor. Failure to comply may cause the coupling bolts to break, with resultant, extensive damage to the equipment.

1. Non-Reverse Coupling

NOTE: Thoroughly clean coupling & all related components prior to mounting on motor.



2. Bolted Coupling - Steel balls not used on Bolted Coupling assemblies.

NOTE: Thoroughly clean coupling & all related components prior to mounting on motor.